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Abundance and Run Timing of Adult Salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2002

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Abstract. – From June 28 to September 19, 2002 a resistance board weir was used to collect abundance, run timing, and biological data from salmon returning to spawn in the Kwethluk River, a tributary to the lower Kuskokwim River. This was the third year of a cooperative project between the U.S. Fish and Wildlife Service and the Organized Village of Kwethluk. This project was initiated under the Federal Subsistence Fishery Management program to obtain the reliable data necessary for managing the Yukon Delta National Wildlife Refuge fishery resources that support intense commercial and subsistence uses.

A total of 34,681 chum Oncorhynchus keta, 8,395 chinook O. tshawytscha, 272 sockeye O. nerka, 1,415 pink O. gorbuscha and 23,298 coho O. kisutch salmon were counted through the weir. Peak weekly passage occurred as follows: June 30 to July 6 for sockeye, July 7 to 13 for chinook and pink, July 14 to 20 for chum, and September 1 to 7 for coho salmon.

Age and sex data was collected for all species but pink salmon. Dominant age groups were as follows: 0.3 for chum, 1.4 for female chinook, 1.2 for male chinook, 1.3 for sockeye, and 2.1 for coho salmon. Overall percentage of females was as follows: 47% for chum, 21% for chinook, 60% for sockeye, and 45% for coho salmon.

Introduction

The Kwethluk River, a lower Kuskokwim River tributary located on the Yukon Delta National Wildlife Refuge (Refuge), provides important spawning and rearing habitat for chum *Oncorhynchus keta*, chinook *O. tshawytscha*, sockeye *O. nerka*, pink *O. gorbuscha*, and coho *O. kisutch* salmon (Figure 1) (Alt 1977; U.S. Fish and Wildlife Service 1992). Adult salmon returning to the Kwethluk River migrate 159 river kilometers (rkms) through the lower Kuskokwim River before reaching the Kwethluk River, and then migrate upstream as many as 160 rkms to reach spawning grounds. In the lower Kuskokwim River, salmon pass through one of Alaska's most intensive subsistence fisheries (Burkey et al. 2001; U.S. Fish and Wildlife Service 1988).

The Alaska National Interest Lands Conservation Act (ANILCA) mandates that salmon populations and their habitats be conserved in their natural diversity within the Refuge; that international treaty obligations be fulfilled; and that subsistence opportunities for local residents be maintained. Salmon escapement studies for the lower Kuskokwim River tributaries on the Refuge are ranked as priorities in the Refuge Fishery Management Plan (U.S. Fish and Wildlife Service 1992). Compliance with ANILCA mandates, however, are not ensured when reliable data regarding fish stocks originating within the Refuge are not available.

Adequate escapements to individual tributaries and main stem spawning areas are required to maintain genetic diversity and sustainable harvests, but management is complicated by the mixed stock nature of the Kuskokwim River fishery. Managers attempt to distribute the catch over time to avoid overharvesting individual stocks, since each may have a distinct migratory timing (Mundy 1982). Stocks or species returning in low numbers or early and late portions of the runs may be overharvested incidentally during the intensive harvesting of abundant stocks. Escapement data are lacking on many of these individual stocks in the Kuskokwim River drainage and are needed for more precise management.

In accordance with ANILCA mandates, the U.S. Fish and Wildlife Service (Service) initiated a three-year study of the Kwethluk River in 1992 to: (1) enumerate adult salmon; (2) describe the run timing of chum, chinook, sockeye, pink, and coho salmon returns; (3) estimate the age, sex, and length composition of adult chum, chinook, sockeye, and coho salmon populations; and (4) identify and count other fish species passing through the weir. High water precluded the installation and operation of the weir in 1991, and the weir was operated only in 1992.

Village leaders passed resolutions opposing the weir in September 1992, consequently discontinuing weir operations. In 1996, the Association of Village Council Presidents (AVCP) initiated a counting tower project, which operated through 1999. Complete counts for chum, chinook, and sockeye salmon were obtained only in 1996 and 1997 because high water delayed operations until late July in 1998 and 1999. In all years of the tower project, high water prevented operations beyond mid-August; therefore, few data exist regarding the abundance and run timing of coho and pink salmon for those years. Additionally, sampling for age, sex, and length information was unsuccessful in 1996 and 1997, and sampling was discontinued in successive years (Cappiello and Sundown 1998; Cappiello and Chris 1999). No comprehensive sampling data exist for the years of tower operation.

On October 1, 1999, the Secretaries of Interior and Agriculture expanded federal subsistence fisheries management in Alaska under Title VIII of ANILCA. To meet this management responsibility, the Federal Subsistence Board established the Fishery Resource Monitoring Program to gather information on fish stock status and trends, subsistence harvest patterns, and traditional ecological knowledge. This program funds studies to gather, analyze, and report information needed to manage subsistence fisheries. Salmon runs originating in the Kwethluk River support subsistence fisheries in both the Kwethluk and Kuskokwim Rivers. Because of the importance of the Kwethluk River, this weir project was one of the first projects funded under this program in 2000. The Kenai Fish and Wildlife Field Office (KFWFO) and the Organized Village of Kwethluk (OVK) have cooperatively conducted this project during 2000, 2001, and 2002.

Study Area

The Kwethluk River is in the lower Kuskokwim River drainage (Figure 1). The region has a subarctic climate characterized by extremes in temperature. Temperatures range from summer highs near $15^{o}C$ to average winter lows near $-12^{o}C$ (Alt 1977). Average yearly precipitation is approximately 50cm with the majority falling between June and October. The rivers generally become ice free in the slow-moving sections by early May and freeze-up occurs in late November. The Kwethuk River originates in the Eek and Crooked Mountains, flows northwest approximately 222 km, and drains an area of about 3,367 km^2. Braiding and gravel substrates are found in the middle section of the river where the weir was placed. Below the middle section, the lower 47 km consists of a deeper, muddy-bottomed channel averaging 53 m in width (Alt 1977). Turbid water conditions that also are characteristic of this lower section are the result of active stream cutting on tundra banks.

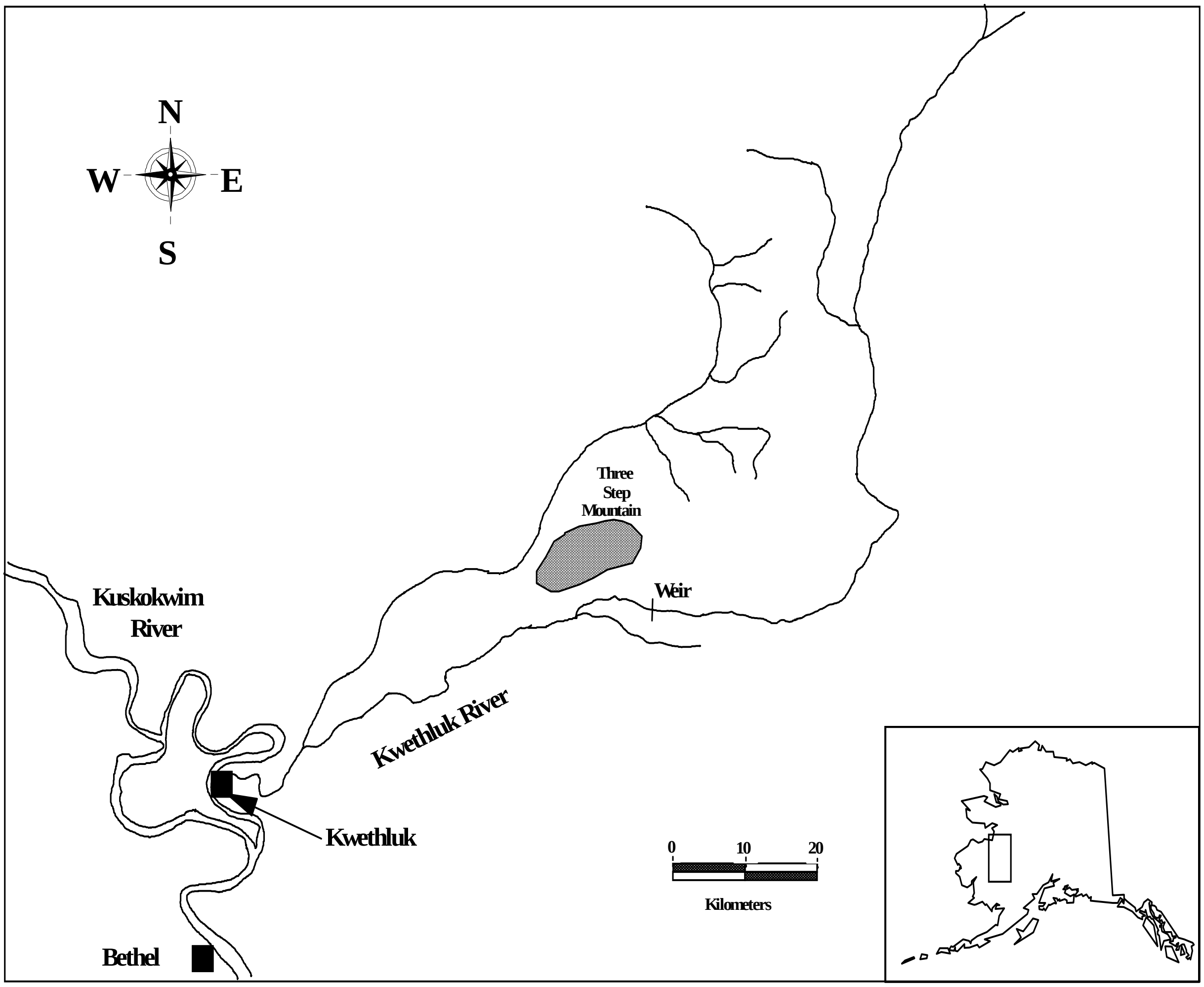

Figure 1. – Location of Kwethluk River weir.

Methods

Weir Operation

A resistance board weir (Tobin 1994) spanning 56 m was installed in the Kwethluk River (62°07'N, 162°48'W) approximately 88 rkm upstream from the Kuskokwim River and 43 air-km east of Kwethluk, Alaska (Figure 1). This location is approximately 2.4 rkm downstream from the 1992 weir site described by Harper (1998). The weir was moved downstream to this section of river in 2000 due to a change in channel morphology at the old location. A staff gauge was installed upstream of the weir to measure daily water levels. Staff gauge measurements were correlated to correspond with the average water depth across the river channel at the upstream edge of the weir. Water temperatures were collected daily at the site, June 28 through September 19, generally between 0800 and 1200 hours.

One live trap and one counting passage way were installed to facilitate sampling and efficient fish passage during various river stage heights. All fish were enumerated to species as they passed through the live trap or counting passage way (Harper 1998). Salmon and resident species that did not pass through these areas, but escaped upstream through the gaps between pickets were not counted. Picket spacing is 4.8 cm, wider than the 3.5 cm spacing used in 1992. Panels with wider picket spacing were designed to remain functional during greater water flow and allow passage of smaller pink salmon between pickets. Fish were passed and counted intermittently between 0001 hours and midnight each day. The duration of counting sessions varied depending on the intensity of fish passage through the weir and was recorded to the nearest 0.25 hour at each counting station.

The weir was inspected for holes and cleaned daily. An observer outfitted with snorkeling gear checked weir integrity and substrate conditions. Cleaning consisted of raking debris from the upstream surface of the weir or walking across each panel until it was partially submerged, allowing the current to wash accumulated detritus downstream.

Estimates of missed salmon passage

For days when high water or a late start prevented accurate counts, estimates were made using percent passage data from previous years with complete data. The passage for the *j*th day with missing data was estimated as:

$$\hat{n}_j = \left[\frac{\sum_{i=1}^{D} \theta_i n_i}{1 - \sum_{i=1}^{D} \theta_i p_i} \right] p_j, \qquad \textbf{(1)}$$

where

n_i = weir passage on day *i*,

p_i = proportional passage on day *i* based on historical data,

θ_i = an indicator variable defined as 1 if passage was observed on day *i*, 0 otherwise, and

D = number of days in the season.

Biological Data

Sample weeks, or strata, began on Sunday and ended the following Saturday. However, a partial week of weir operation shortened the length of the last strata. Sampling generally commenced near the beginning of the week, and an effort was made to obtain a weekly quota of 210 chum, 210 chinook, 210 sockeye, and 170 coho salmon in as short a period (1-3 days) as possible, to approximate a pulse or snapshot sample (Geiger et al. 1990). All target species within the trap were sampled to prevent bias.

Fish sampling consisted of measuring length, determining sex, collecting scales, and then releasing the fish upstream of the weir. Length was measured from mideye to the fork of the caudal fin and rounded to the nearest 5mm. Sex was determined by observing external characteristics, including presence of ovipositor or gametes. Scales were removed from the preferred area for age determination (Koo 1962, Mosher 1968). Three scales were collected from each chum salmon, one from each sockeye salmon, and four scales from each chinook and coho salmon. Scale impressions were made on cellulose acetate cards using a heated scale press and examined with a microfiche reader. An Alaska Department of Fish and Game (Department) biologist determined age and reported results according to the European Method (Koo 1962).

Mean lengths of males and females by age were compared using a Welch's two-tailed *t* test for samples of unequal variance at α=0.05 (USFWS 2003). Age and sex composition were estimated using a stratified sampling design (Cochran 1977). Chi-square contingency table analysis was used to test for differences in age composition between the sexes. Because the standard test only applies to data collected under simple random sampling, adjustments were made to the test statistic, following Rao and Thomas (1989), to account for the impact of our stratified sampling design on the results. The O^2 statistic, hereafter referred to as $O^2(\delta.)$, was divided by the mean generalized design effect, as a first-order correction to the standard test (Rao and Thomas 1989). Estimated design effects for the cells and marginals are presented in the results. Age and sex specific escapements in a stratum, $\hat{A}_{hij}$, and their variances, $V[\hat{A}_{hij}]$, were estimated as:

$$\hat{A}_{hij} = N_h \hat{p}_{hij}\,; \tag{2}$$

and

$$\hat{V}\left[\hat{A}_{hij}\right] = N_h^2 \left(1 - \frac{n_h}{N_h}\right)\left(\frac{\hat{p}_{hij}(1-\hat{p}_{hij})}{n_h - 1}\right) \tag{3}$$

where

N_h = total escapement of a given species during stratum *h*;

$\hat{p}_{hij}$ = estimated proportion of age *i* and sex *j* fish of a given sample in stratum *h;* and

n_h = total number of fish, of a given species, in the sample for stratum *h.*

Abundance estimates and their variances for each stratum were summed to obtain age and sex-specific escapements for the season, as follows:

$$\hat{A}_{ij} = \sum^{\hat{A}_{hij}}\ ; \tag{4}$$

and

$$\hat{V}\left[\hat{A}_{ij}\right] = \sum^{\hat{V}(\hat{A}_{hij})} \quad ; \qquad \textbf{(5)}$$

where

$\hat{A}_{ij}$ = estimated total escapement for age *i* and sex *j* fish of a given species.

Results

Weir Operation

Several attempts at early installation of the weir were made but were unsuccessful due to high water. The weir was installed and operational on June 28, 2002. Due to a late start, a small proportion of both the chinook and chum salmon escapement may have been missed. Estimates of the missed portions were made. During the operational period, no major difficulties were experienced. The last day of counts was September 19, 2002. Water level data was collected on a daily basis (Appendix 1).

Biological Data

A total of 35,681 chum, 8,395 chinook, 272 sockeye, 1,415 pink, and 23, 298 coho salmon were counted through the weir. Estimates of missed passage give a total count of 35,854 chum and 8,502 chinook salmon. Additionally, 49 Dolly Varden *Salvelinus malma*, 524 whitefish *Coregonus* spp., and 8 rainbow trout *Oncorhynchus mykiss* were also counted.

Chum salmon— A total of 35,681 chum salmon passed through the weir from June 28 to September 13, 2002. Estimates of the uncounted early run bring the total to 35,854. Peak passage (N = 9923) occurred during the week of July 14 to 20 (Figure 2). Median passage occurred on July 17. Gillnet marks were observed on approximately 3% (N = 979) of the chum salmon passing through the weir (Appendix 2).

Four age groups were identified from scale samples (0.2, 0.3, 0.4, 0.5). Analysis indicated a significant difference in age composition between the sexes ($X^2(\hat{\delta})$ =200.8, df=3, P=<0.001). For both male and females, the 0.3 age group predominated (68% and 74% respectively), and the 0.3 and 0.4 age groups combined for over 90% of the total. Females comprised an estimated 47% of the total escapement, and over 50% in the last two strata (Figure 3, Appendix 3).

Results of t-test analysis indicate that males were larger than females at all ages with sufficient sample sizes (0.2, 0.3, 0.4, 0.5) to allow for analysis (Appendix 4).

Chinook Salmon—A total of 8,395 chinook salmon passed through the weir from June 28 to September 8, 2002. Estimates of the uncounted early run bring the total to 8,502. Peak passage (N = 2,549) occurred during the week of July 7 to 13 (Figure 2). Median passage occurred on July 9. Gillnet marks were observed on approximately 4% (N = 353) of chinook passing through the weir (Appendix 2).

Four age groups were identified from samples (1.2, 1.3, 1.4, 1.5). Analysis indicated a significant difference in age composition between the sexes ($X^2(\hat{\delta})$ = 305.2, P<0.001, df=3). Throughout the season, age 1.4 was the predominant age group for females (61%). For males, the 1.2 age group was predominant (59%). In males, ages 1.2 and 1.3 accounted for the majority (92%) of the escapement. In females, ages 1.3 and 1.4 accounted for the majority (92%) of the escapement. Females comprised an estimated 21% of the total escapement. Males dominated throughout the season, never falling below 70% of escapement (Figure 3, Appendix 5)

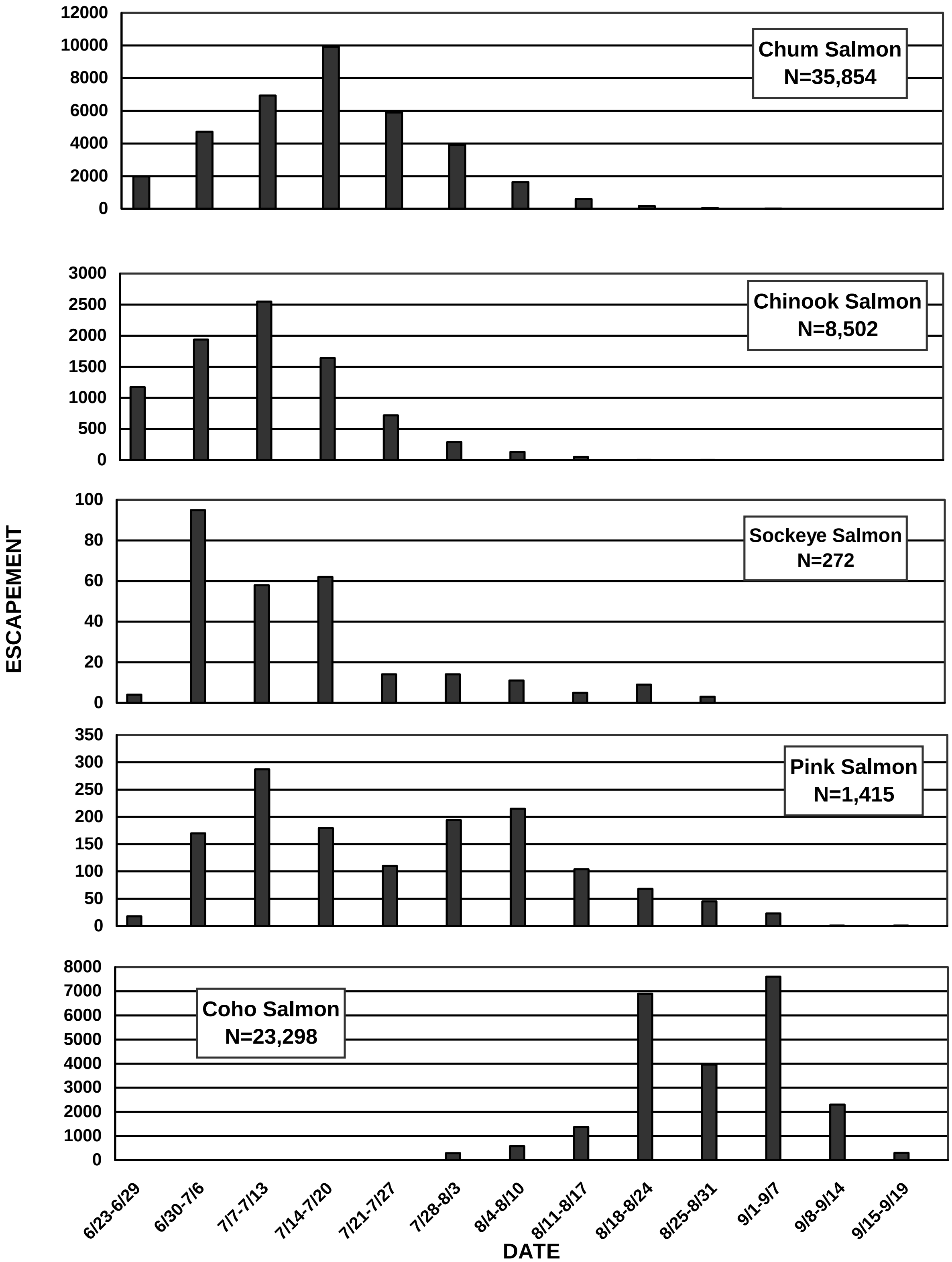

Figure 2. – Weekly escapement, including estimates of missed passage, of chum, chinook, sockeye, pink and coho salmon, Kwethluk River weir, Alaska, 2002.

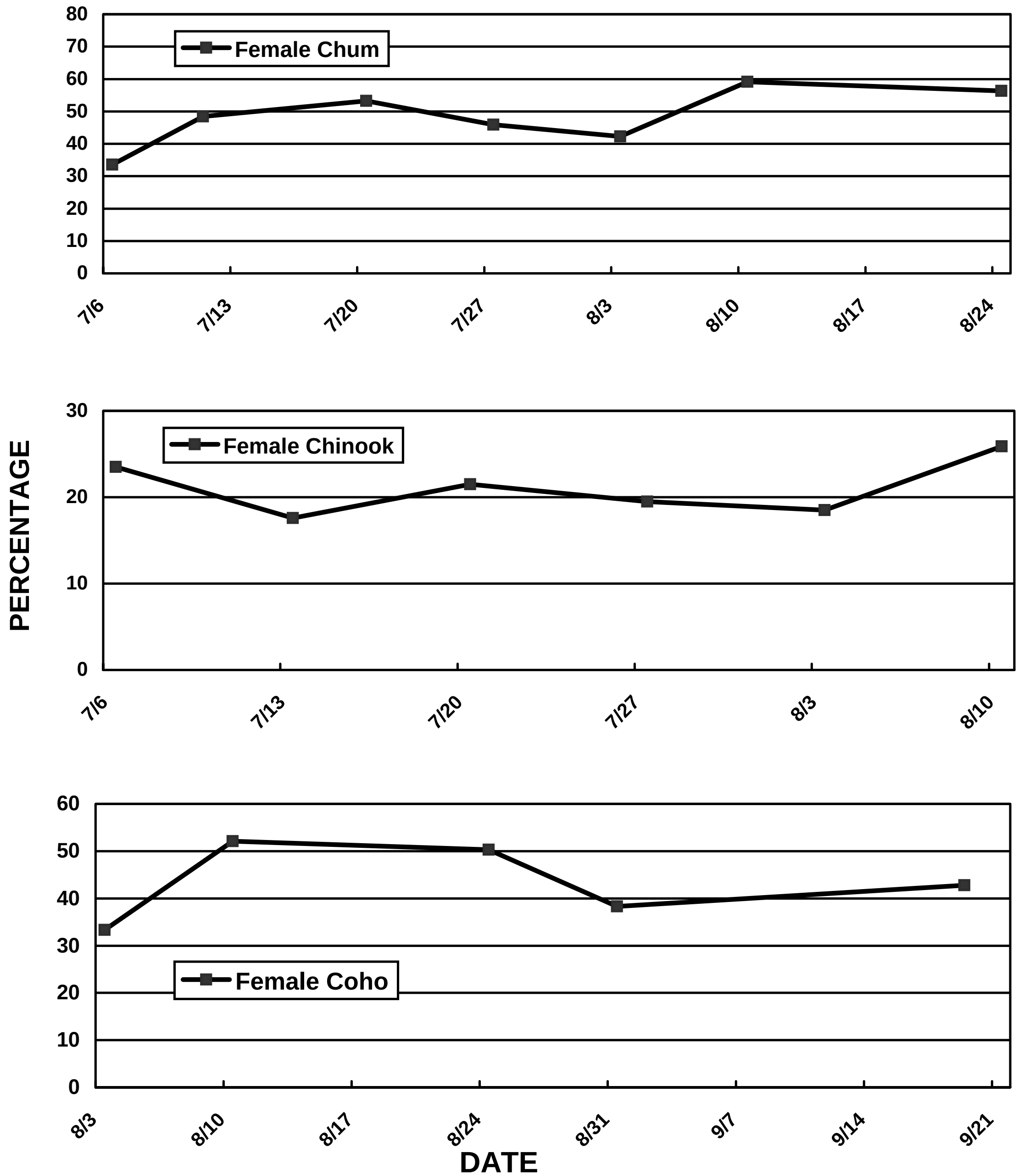

Figure 3. – Percent composition of females for chum, chinook, and coho salmon, by sampling stratum (ending date), Kwethluk River weir, Alaska, 2002.

Females were larger than males for ages 1.3 and 1.4 (Appendix 4). Sufficient samples for other ages were not available.

Sockeye Salmon—A total of 272 sockeye salmon passed through the weir from June 29 to August 24. Peak passage (N = 95) occurred during the week of June 30 to July 6 (Figure 6). Median passage occurred on July 11. No sockeye salmon with gillnet marks were observed (Appendix 2).

Four age groups were identified from scale samples (1.2, 1.3, 1.4, 2.3). Analysis indicated no significant difference in age composition between sexes ($X^2(\hat{\delta})$ =0.624, df=3, P=0.891). However this may be due to small sample sizes. Overall, males comprised an estimated 40% of the total escapement. The 1.3 age group was predominant in both males and females (71% and 69%, respectively). Due to the small overall size of the escapement, several strata had small or nonexistent sample sizes (Appendix 6).

Pink Salmon—Weir picket spacing allows some pink salmon to pass upriver uncounted, however, a total of 1,415 were counted through the weir. Peak passage (N = 287) occurred during the week of July 7 to 13 (Figure 7). Median passage occurred on July 25. Three pink salmon were observed to have gillnet marks. Pink salmon were not sampled for age, sex, or length (Appendix 2).

Coho Salmon—A total of 23,298 coho salmon passed through the weir from July 29 to September 19. Peak passage (N = 7608) occurred during the week of September 1 to 7 (Figure 8). Median passage occurred on August 28. Gillnet marks were observed on 1% (N = 254) of coho salmon passing through the weir (appendix 2).

Three age groups were identified from scale samples (1.1, 2.1, 3.1). Analysis indicated a significant difference in the age composition between sexes ($X^2(\hat{\delta})$ = 64.5, df =2, P<0.0001). Females comprised an estimated 45% of the total escapement. Throughout the season, males comprised the majority of the escapement, with the exception of two periods where females held a slight majority (Figure 9, Appendix 7). For both males and females the 2.1 age group was predominant (93% and 93%, respectively).

Males were larger than females at age 2.1 (P=0.001). At age 3.1 differences in lengths were not considered significant (P=0.780). Age 1.1 did not have sufficient sample size to allow for analysis (Appendix 4).

Discussion

Weir Operation

High water prevented the installation of the weir until June 28. Data from both 1992 and 2000 indicate that chum and chinook salmon are generally present and passing the weir prior to that time. Estimates of the missed proportion were constructed and added to the data for analysis. Counts for other species are considered complete.

Picket spacing on the weir is such that many pink salmon and resident fish species are able to pass between pickets. Other salmon species are effectively blocked. Thus, counts of pink salmon, whitefish, northern pike, rainbow trout, and Dolly Varden are below actual passage.

The Kwethluk River weir has had full seasons of operation in 1992, 2000, and 2002. From 1993 to 1999 the weir was not operated due to opposition from the Organized Village of Kwethluk. From 1996 through 1999 AVCP operated a counting tower near the present location of the weir, but had mixed results due to high and turbid water, and did not gather age, sex, and length samples. In 2001, high water prevented installation of the weir until August. It was operational from August 12 to September 13.

Biological Data

The Kuskokwim River chum and chinook salmon rebuilding plan remained in effect during 2002. No commercial fishing season for chum or chinook salmon occurred during 2002 and subsistence fishing was limited to four days per week. These two factors helped increase escapement to the spawning grounds in 2002 (Alaska Department of Fish and Game, 2002)

Chum Salmon—Estimated chum salmon escapement during the 2002 season (*N* = 35,854) was above 1992 weir (30,595) and 1996 tower (26,049) counts, but well above the last complete weir count of 11, 691 during the 2000 season (Appendix 8). Median escapement (July 17) was only one day later than in 2000. Gillnet marks were observed on 3% of the sampled chum salmon. This the same as in 2000 (Harper and Watry 2001) and well below the 5% observed in 1992 (Harper 1998). The 47% proportion of females is slightly less than the 50% observed in 2000. By period, the proportion of females showed the same pattern of increase-decrease-increase seen in 2000 (Harper and Watry 2001).

Chinook Salmon—Estimated chinook salmon escapement (N = 8,502) is more than twice the 2000 escapement (N = 3,547), the last year for which a full count is available, but less than the 1992 weir count (N = 9,675) (Harper and Watry 2001). The median passage date of July 9 was earlier than in 2001 (July 13). The proportion of gillnet marked fish observed, 4%, was slightly higher than in 2000 (4%), but well below the 10% observed in 1992 (Harper and Watry 2001, Appendix 8). As in 2000, males made up the majority of the overall run and were the majority in each sampling strata. Females made up 21% of the total escapement, less than in both the 1992 (25%) and 2001 (22%) seasons (Harper and Watry 2001).

Sockeye Salmon—The Kwethluk River is not known for having a large population of sockeye salmon, and they are harvested as by-catch with other species. Escapement in 2002 (*N*= 272) was well below the 1,049 counted in 2000 (Appendix 8). No sockeye salmon with gillnet marks were observed. This is the first year this has happened, but it may be an artifact of the small number of fish passing the weir. The proportion of females (60%) was higher than in 2001 (49%) and nearly identical to the 60% observed in 1992.

Pink Salmon—The observed pink salmon escapement of 1,415, is very close to the 1,407 observed in 2000 (Harper and Watry 2001). These are the only two years that can be compared, due to the wider picket spacing used in the weir panels that allows some pink salmon to escape upstream without being counted. These counts should be considered indicators of relative abundance and run timing.

Coho Salmon—The observed count for coho salmon (N = 23,298) is considered to be complete. This is the second lowest escapement observed at the weir, only slightly greater than the 21,535 estimated escapement in 2001 (Roettiger et al. 2002). Compared to the 2001 and 2000 (N= 25,610) escapements, 2002 appears average (appendix 8). Median run timing, August 27, compares well with the timing of the 2001 run (August 25), but is a bit late compared to 2000 (August 21).

The proportion of gillnet marked coho salmon (1%) was the lowest ever recorded at the weir (1992 3%, 2000 2%, 2001 2%) (Harper and Watry 2001, Roettiger et al. 2002). This may be due to the fact that only two commercial openings occurred during the coho migration. Both were characterized by low participation and low total catch.

Females comprised 45% of the total coho salmon escapement. This compares well with the 43% observed in 1992 and the 45% observed in 2000. In 2001, the proportion of females was 51%, but may have been skewed due to small sample size (Roettiger et al. 2002).

Recommendations

The Kwethluk River weir continues to be an important tool for monitoring salmon stocks originating on the Yukon Delta National Wildlife Refuge and providing information to the Alaska Department of Fish and Game and Federal In season Manager for management of Lower Kuskokwim River fisheries. It is recommended that the weir project continue to be operated on a yearly basis. It is further recommended that operations be continued into September to get as complete a count of coho salmon as possible. Early installation, prior to spring runoff, is also recommended.

Acknowledgements

This project (FIS 00-019) was funded under Cooperative Agreement 7018J258 between the U.S. Fish and Wildlife Service and the Organized Village of Kwethluk. The Cooperative Agreement provided funding to the village, to help with their capacity in becoming active partners in monitoring important Yukon Delta National Wildlife Refuge fishery resources that are used for subsistence by the people of Kwethluk and other Kuskokwim River villages. As a partner, Kwethluk hired personnel locally and purchased operational supplies and equipment. The Organized Village of Kwethluk also provided the administrative support and direction to their employees and promoted project understanding to the people of the village. Many village residents contributed to the success of the Kwethluk weir. Abraham Alexie Jr., Oscar Larson, Robert Michael, and Frank Frank were instrumental in counting fish, staging, and resupply at the weir. John Owens, Chariton Epchook, and Boris Epchook helped with administration and other support functions. Oscar Larson also provided direct project support, administration of village reports, and inventory controls.

Special appreciation is extended to those other people who contributed to this project: Ken Gates and Charlie Weeks (USFWS) helped with the installation and early training of the crews. Dan Nolfi, Ty Wyatt, and Joe Cadieux (USFWS) staffed the weir. Thanks to the entire Yukon Delta National Wildlife Refuge staff for their support. We also appreciate the assistance of the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, A-Y-K Region, and Larry DuBois and Doug Molyneaux for scale sample analysis.

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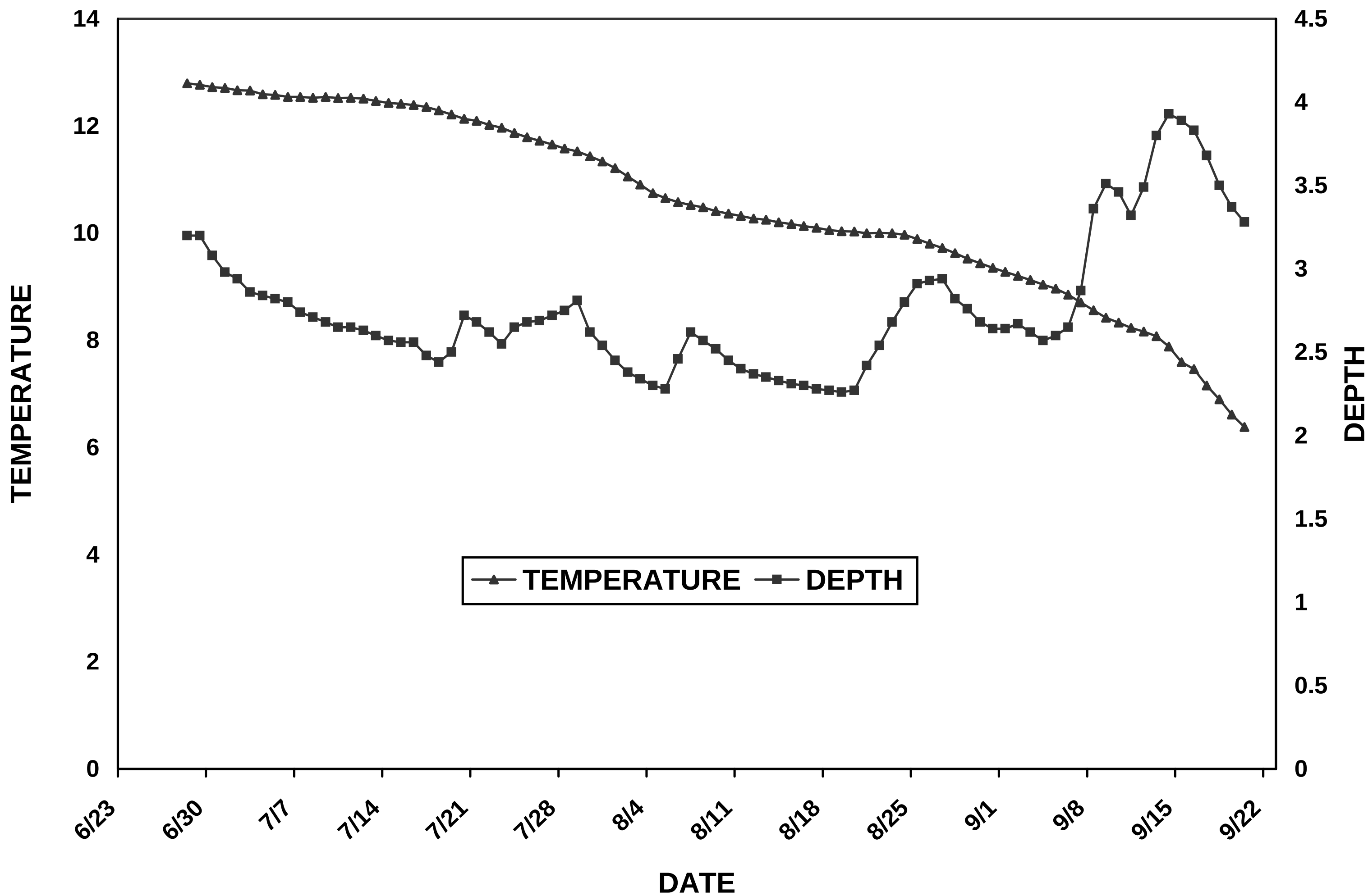

Appendix 1. – Daily average temperature and daily average water depth at the Kwethluk River weir, Alaska, 2002.

Appendix 2. – Daily count, cumulative daily count, and cumulative daily proportion for all salmon species passing through the Kwethluk River Weir, Alaska, 2002. Estimated daily counts are shaded. Cumulative proportions are shaded from the 25th to 75th percentile.

	Chum			Chinook			Sockeye			Pink			Coho		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
Date	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
6/22	48	48	0.001	1	1	0.000									
6/23	89	137	0.004	6	7	0.001									
6/24	116	253	0.007	9	16	0.002									
6/25	224	477	0.013	19	35	0.004									
6/26	384	861	0.024	32	67	0.008									
6/27	312	1,173	0.033	40	107	0.013									
6/28	234	1,407	0.039	307	414	0.049	0	0	0.000	0	0	0.000	0	0	0.000
6/29	581	1,988	0.055	760	1,174	0.138	4	4	0.015	18	18	0.013	0	0	0.000
6/30	320	2,308	0.064	168	1,342	0.158	3	7	0.026	3	21	0.015	0	0	0.000
7/1	214	2,522	0.070	83	1,425	0.168	9	16	0.059	4	25	0.018	0	0	0.000
7/2	482	3,004	0.084	111	1,536	0.181	21	37	0.136	9	34	0.024	0	0	0.000
7/3	882	3,886	0.108	291	1,827	0.215	22	59	0.217	24	58	0.041	0	0	0.000
7/4	823	4,709	0.131	426	2,253	0.265	11	70	0.257	24	82	0.058	0	0	0.000
7/5	708	5,417	0.151	144	2,397	0.282	7	77	0.283	32	114	0.081	0	0	0.000
7/6	1283	6,700	0.187	717	3,114	0.366	22	99	0.364	74	188	0.133	0	0	0.000
7/7	925	7,625	0.213	540	3,654	0.430	10	109	0.401	69	257	0.182	0	0	0.000
7/8	448	8,073	0.225	246	3,900	0.459	4	113	0.415	17	274	0.194	0	0	0.000
7/9	853	8,926	0.249	388	4,288	0.504	2	115	0.423	36	310	0.219	0	0	0.000
7/10	1291	10,217	0.285	266	4,554	0.536	19	134	0.493	42	352	0.249	0	0	0.000
7/11	1281	11,498	0.321	486	5,040	0.593	11	145	0.533	40	392	0.277	0	0	0.000
7/12	1423	12,921	0.360	360	5,400	0.635	9	154	0.566	55	447	0.316	0	0	0.000
7/13	722	13,643	0.381	263	5,663	0.666	3	157	0.577	28	475	0.336	0	0	0.000
7/14	949	14,592	0.407	275	5,938	0.698	6	163	0.599	25	500	0.353	0	0	0.000
7/15	1073	15,665	0.437	92	6,030	0.709	7	170	0.625	6	506	0.358	0	0	0.000
7/16	1538	17,203	0.480	209	6,239	0.734	12	182	0.669	18	524	0.370	0	0	0.000
7/17	1496	18,699	0.522	288	6,527	0.768	22	204	0.750	25	549	0.388	0	0	0.000
7/18	1792	20,491	0.572	211	6,738	0.793	4	208	0.765	38	587	0.415	0	0	0.000
7/19	1530	22,021	0.614	334	7,072	0.832	6	214	0.787	33	620	0.438	0	0	0.000
7/20	1545	23,566	0.657	232	7,304	0.859	5	219	0.805	34	654	0.462	0	0	0.000
7/21	1231	24,797	0.692	124	7,428	0.874	3	222	0.816	18	672	0.475	0	0	0.000

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	Chum			Chinook			Sockeye			Pink			Coho		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
Date	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
7/22	841	25,638	0.715	81	7,509	0.883	2	224	0.824	10	682	0.482	0	0	0.000
7/23	1002	26,640	0.743	103	7,612	0.895	4	228	0.838	9	691	0.488	0	0	0.000
7/24	675	27,315	0.762	137	7,749	0.911	0	228	0.838	8	699	0.494	0	0	0.000
7/25	672	27,987	0.781	114	7,863	0.925	0	228	0.838	19	718	0.507	0	0	0.000
7/26	698	28,685	0.800	71	7,934	0.933	5	233	0.857	22	740	0.523	0	0	0.000
7/27	786	29,471	0.822	87	8,021	0.943	0	233	0.857	24	764	0.540	0	0	0.000
7/28	557	30,028	0.838	73	8,094	0.952	1	234	0.860	24	788	0.557	0	0	0.000
7/29	540	30,568	0.853	57	8,151	0.959	2	236	0.868	15	803	0.567	15	15	0.001
7/30	631	31,199	0.870	51	8,202	0.965	2	238	0.875	25	828	0.585	17	32	0.001
7/31	627	31,826	0.888	42	8,244	0.970	2	240	0.882	29	857	0.606	52	84	0.004
8/1	633	32,459	0.905	17	8,261	0.972	3	243	0.893	38	895	0.633	58	142	0.006
8/2	441	32,900	0.918	26	8,287	0.975	1	244	0.897	32	927	0.655	60	202	0.009
8/3	489	33,389	0.931	22	8,309	0.977	3	247	0.908	31	958	0.677	85	287	0.012
8/4	463	33,852	0.944	30	8,339	0.981	2	249	0.915	67	1,025	0.724	114	401	0.017
8/5	117	33,969	0.947	20	8,359	0.983	2	251	0.923	16	1,041	0.736	22	423	0.018
8/6	240	34,209	0.954	13	8,372	0.985	3	254	0.934	32	1,073	0.758	51	474	0.020
8/7	235	34,444	0.961	16	8,388	0.987	3	257	0.945	20	1,093	0.772	51	525	0.023
8/8	264	34,708	0.968	27	8,415	0.990	0	257	0.945	23	1,116	0.789	47	572	0.025
8/9	126	34,834	0.972	13	8,428	0.991	1	258	0.949	18	1,134	0.801	45	617	0.026
8/10	187	35,021	0.977	14	8,442	0.993	0	258	0.949	39	1,173	0.829	242	859	0.037
8/11	163	35,184	0.981	16	8,458	0.995	1	259	0.952	18	1,191	0.842	112	971	0.042
8/12	113	35,297	0.984	6	8,464	0.996	0	259	0.952	26	1,217	0.860	300	1,271	0.055
8/13	72	35,369	0.986	10	8,474	0.997	0	259	0.952	16	1,233	0.871	80	1,351	0.058
8/14	74	35,443	0.989	3	8,477	0.997	0	259	0.952	16	1,249	0.883	101	1,452	0.062
8/15	80	35,523	0.991	7	8,484	0.998	0	259	0.952	14	1,263	0.893	282	1,734	0.074
8/16	52	35,575	0.992	6	8,490	0.999	4	263	0.967	7	1,270	0.898	164	1,898	0.081
8/17	41	35,616	0.993	2	8,492	0.999	0	263	0.967	7	1,277	0.902	332	2,230	0.096
8/18	35	35,651	0.994	0	8,492	0.999	1	264	0.971	16	1,293	0.914	651	2,881	0.124
8/19	31	35,682	0.995	2	8,494	0.999	0	264	0.971	3	1,296	0.916	309	3,190	0.137
8/20	36	35,718	0.996	1	8,495	0.999	4	268	0.985	9	1,305	0.922	390	3,580	0.154

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	Chum			Chinook			Sockeye			Pink			Coho		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
Date	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
8/21	26	35,744	0.997	1	8,496	0.999	0	268	0.985	2	1,307	0.924	845	4,425	0.190
8/22	21	35,765	0.998	0	8,496	0.999	1	269	0.989	8	1,315	0.929	986	5,411	0.232
8/23	18	35,783	0.998	1	8,497	0.999	0	269	0.989	9	1,324	0.936	1,573	6,984	0.300
8/24	10	35,793	0.998	0	8,497	0.999	3	272	1.000	21	1,345	0.951	2,148	9,132	0.392
8/25	8	35,801	0.999	2	8,499	1.000	0	272	1.000	16	1,361	0.962	500	9,632	0.413
8/26	7	35,808	0.999	0	8,499	1.000	0	272	1.000	1	1,362	0.963	560	10,192	0.437
8/27	11	35,819	0.999	0	8,499	1.000	0	272	1.000	0	1,362	0.963	478	10,670	0.458
8/28	5	35,824	0.999	1	8,500	1.000	0	272	1.000	7	1,369	0.967	1,110	11,780	0.506
8/29	5	35,829	0.999	0	8,500	1.000	0	272	1.000	3	1,372	0.970	255	12,035	0.517
8/30	4	35,833	0.999	0	8,500	1.000	0	272	1.000	2	1,374	0.971	364	12,399	0.532
8/31	3	35,836	0.999	0	8,500	1.000	0	272	1.000	16	1,390	0.982	692	13,091	0.562
9/1	4	35,840	1.000	0	8,500	1.000	0	272	1.000	6	1,396	0.987	778	13,869	0.595
9/2	3	35,843	1.000	0	8,500	1.000	0	272	1.000	10	1,406	0.994	1,255	15,124	0.649
9/3	1	35,844	1.000	0	8,500	1.000	0	272	1.000	0	1,406	0.994	544	15,668	0.673
9/4	2	35,846	1.000	1	8,501	1.000	0	272	1.000	2	1,408	0.995	1,598	17,266	0.741
9/5	2	35,848	1.000	0	8,501	1.000	0	272	1.000	3	1,411	0.997	1,090	18,356	0.788
9/6	2	35,850	1.000	0	8,501	1.000	0	272	1.000	2	1,413	0.999	1,140	19,496	0.837
9/7	0	35,850	1.000	0	8,501	1.000	0	272	1.000	0	1,413	0.999	1,203	20,699	0.888
9/8	0	35,850	1.000	1	8,502	1.000	0	272	1.000	0	1,413	0.999	707	21,406	0.919
9/9	1	35,851	1.000	0	8,502	1.000	0	272	1.000	0	1,413	0.999	303	21,709	0.932
9/10	1	35,852	1.000	0	8,502	1.000	0	272	1.000	0	1,413	0.999	308	22,017	0.945
9/11	0	35,852	1.000	0	8,502	1.000	0	272	1.000	0	1,413	0.999	290	22,307	0.957
9/12	1	35,853	1.000	0	8,502	1.000	0	272	1.000	1	1,414	0.999	448	22,755	0.977
9/13	1	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	178	22,933	0.984
9/14	0	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	68	23,001	0.987
9/15	0	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	68	23,069	0.990
9/16	0	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	81	23,150	0.994
9/17	0	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	47	23,197	0.996
9/18	0	35,854	1.000	0	8,502	1.000	0	272	1.000	0	1,414	0.999	47	23,244	0.998
9/19	0	35,854	1.000	0	8,502	1.000	0	272	1.000	1	1,415	1.000	54	23,298	1.000

Appendix 3. – Estimated age and sex of weekly chum salmon escapements through the Kwethluk River weir, Alaska, 2001; and estimated design effects of the stratified sampling design. Strata with small sample sizes were combined with adjacent strata for statistical purposes.

		Brood Year and Age Class				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Stratum 1:	6/23 - 7/6					
Sampling Dates:	7/1 - 7/3					
Male:	Number in Sample:	0	56	38	3	97
	Estimated % of Escapement:	0	38.4	26	2.1	66.4
	Estimated Escapement:	0	2,120	1,439	114	3,672
	Standard Error:	0	220.2	198.7	64.2	
Female:	Number in Sample:	1	27	20	1	49
	Estimated % of Escapement:	0.7	18.5	13.7	0.7	33.6
	Estimated Escapement:	38	1,022	757	38	1,855
	Standard Error:	37.4	175.8	155.7	37.4	
Total:	Number in Sample:	1	83	58	4	146
	Estimated % of Escapement:	0.7	56.8	39.7	2.7	100
	Estimated Escapement:	38	3,142	2,196	151	5,527
	Standard Error:	37.4	224.3	221.6	73.9	
Stratum 2:	7/7 - 7/13					
Sampling Dates:	7/7 - 7/11					
Male:	Number in Sample:	2	68	28	1	99
	Estimated % of Escapement:	1	35.4	14.6	0.5	51.6
	Estimated Escapement:	72	2,459	1,013	36	3,580
	Standard Error:	50.3	236.9	174.8	35.7	
Female:	Number in Sample:	1	71	21	0	93
	Estimated % of Escapement:	0.5	37	10.9	0	48.4
	Estimated Escapement:	36	2,567	759	0	3,363
	Standard Error:	35.7	239.1	154.6	0	
Total:	Number in Sample:	3	139	49	1	192
	Estimated % of Escapement:	1.6	72.4	25.5	0.5	100
	Estimated Escapement:	108	5,026	1,772	36	6,943
	Standard Error:	61.4	221.5	216	35.7	

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		Brood Year and Age Class				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Stratum 3:	7/14 - 7/20					
Sampling Dates:	7/15					
Male:	Number in Sample:	1	57	20	3	81
	Estimated % of Escapement:	0.6	32.9	11.6	1.7	46.8
	Estimated Escapement:	57	3,269	1,147	172	4,646
	Standard Error:	56.9	352.5	239.8	97.9	
Female:	Number in Sample:	0	69	20	3	92
	Estimated % of Escapement:	0	39.9	11.6	1.7	53.2
	Estimated Escapement:	0	3,958	1,147	172	5,277
	Standard Error:	0	367.2	239.8	97.9	
Total:	Number in Sample:	1	126	40	6	173
	Estimated % of Escapement:	0.6	72.8	23.1	3.5	100
	Estimated Escapement:	57	7,227	2,294	344	9,923
	Standard Error:	56.9	333.6	316.2	137.2	

Stratum 4:	7/21 - 7/27					
Sampling Dates:	7/22					
Male:	Number in Sample:	5	73	20	0	98
	Estimated % of Escapement:	2.8	40.3	11	0	54.1
	Estimated Escapement:	163	2,382	652	0	3,197
	Standard Error:	71	212.6	135.9	0	
Female:	Number in Sample:	4	71	8	0	83
	Estimated % of Escapement:	2.2	39.2	4.4	0	45.9
	Estimated Escapement:	130	2,316	261	0	2,708
	Standard Error:	63.7	211.6	89.1	0	
Total:	Number in Sample:	9	144	28	0	181
	Estimated % of Escapement:	5	79.6	15.5	0	100
	Estimated Escapement:	294	4,698	913	0	5,905
	Standard Error:	94.2	174.8	156.7	0	

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		Brood Year and Age Class				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Stratum 5:	7/28 - 8/3					
Sampling Dates:	7/29					
Male:	Number in Sample:	14	70	20	1	105
	Estimated % of Escapement:	7.7	38.5	11	0.5	57.7
	Estimated Escapement:	301	1,507	431	22	2,260
	Standard Error:	75.8	138.4	88.9	21	
Female:	Number in Sample:	5	60	11	1	77
	Estimated % of Escapement:	2.7	33	6	0.5	42.3
	Estimated Escapement:	108	1,292	237	22	1,658
	Standard Error:	46.5	133.7	67.8	21	
Total:	Number in Sample:	19	130	31	2	182
	Estimated % of Escapement:	10.4	71.4	17	1.1	100
	Estimated Escapement:	409	2,799	667	43	3,918
	Standard Error:	87	128.5	106.9	29.6	

Stratum 6:	8/4 - 8/10					
Sampling Dates:	8/5 - 8/7					
Male:	Number in Sample:	12	50	9	1	72
	Estimated % of Escapement:	6.8	28.4	5.1	0.6	40.9
	Estimated Escapement:	111	464	83	9	668
	Standard Error:	29.4	52.6	25.7	8.8	
Female:	Number in Sample:	31	59	14	0	104
	Estimated % of Escapement:	17.6	33.5	8	0	59.1
	Estimated Escapement:	287	547	130	0	964
	Standard Error:	44.4	55	31.5	0	
Total:	Number in Sample:	43	109	23	1	176
	Estimated % of Escapement:	24.4	61.9	13.1	0.6	100
	Estimated Escapement:	399	1,011	213	9	1,632
	Standard Error:	50.1	56.6	39.3	8.8	

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		Brood Year and Age Class				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Stratum 7:	8/11 - 8/24					
Sampling Dates:	8/19 - 8/20					
Male:	Number in Sample:	3	4	0	0	7
	Estimated % of Escapement:	18.8	25	0	0	43.8
	Estimated Escapement:	156	208	0	0	364
	Standard Error:	83.1	92.2	0	0	
Female:	Number in Sample:	1	8	0	0	9
	Estimated % of Escapement:	6.3	50	0	0	56.3
	Estimated Escapement:	52	417	0	0	469
	Standard Error:	51.6	106.5	0	0	
Total:	Number in Sample:	4	12	0	0	16
	Estimated % of Escapement:	25	75	0	0	100
	Estimated Escapement:	208	625	0	0	833
	Standard Error:	92.2	92.2	0	0	

Strata 1-7:						
Male:	Number in Sample:	37	378	135	9	559
	% Males in Age Group:	4.7	67.5	25.9	1.9	100
	Estimated % of Escapement:	2.5	35.8	13.7	1	53
	Estimated Escapement:	862	12,409	4,765	353	18,388
	Standard Error:	156	551.8	393.2	124.5	
	Estimated Design Effects:	0.918	1.204	1.185	1.395	1.196
Female:	Number in Sample:	43	365	94	5	507
	% Females in Age Group:	4	74.4	20.2	1.4	100
	Estimated % of Escapement:	1.9	34.9	9.5	0.7	47
	Estimated Escapement:	652	12,119	3,291	231	16,293
	Standard Error:	116.3	547.7	345.2	106.9	
	Estimated Design Effects:	0.678	1.199	1.259	1.556	1.196
Total:	Number in Sample:	80	743	229	14	1,066
	Estimated % of Escapement:	4.4	70.7	23.2	1.7	100
	Estimated Escapement:	1,513	24,528	8,056	584	34,681
	Standard Error:	189.3	519	483	162.9	
	Estimated Design Effects:	0.789	1.182	1.188	1.449	

Appendix 4. – Results of Welch's t-Test (independent samples, unequal variance) for difference in mean length between male and female salmon at given ages. A P-value <0.05 is assumed to indicate a significant difference in mean size.

Chum Salmon								
Age	0.2		0.3		0.4		0.5	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Mean	567	538	594	561	609	574	624	553
Variance	1061	984	771	926	1344	995	1224	697
Observations	41	54	414	404	146	100	9	16
Hypothesized Difference	0		0		0		0	
df	85		805		232		13	
t Stat	4.314		15.956		7.944		5.328	
P(T<=t) two-tail	0		0		0		0	
t Critical two-tail	1.988		1.963		1.97		2.16	

Chinook Salmon				
Age	1.3		1.4	
	Male	*Female*	*Male*	*Female*
Mean	672	719	801	852
Variance	5046	7192	10991	3032
Observations	210	42	55	103
Hypothesized Difference	0		0	
df	53		70	
t Stat	-3.326		-3.348	
P(T<=t) two-tail	0.002		0.001	
t Critical two-tail	2.006		1.994	

Coho Salmon				
Age	2.1		3.1	
	Male	*Female*	*Male*	*Female*
Mean	595	583	577	572
Variance	1985	1278	4186	3561
Observations	284	230	23	24
Hypothesized Difference	0		0	
df	512		44	
t Stat	3.348		0.281	
P(T<=t) two-tail	0.001		0.78	
t Critical two-tail	1.965		2.015	

Appendix 5. – Estimated age and sex composition of weekly chinook salmon escapements through the Kwethluk River weir, Alaska, 2001; and estimated design effects of the stratified sampling design. Strata with small sample sizes were combined with adjacent strata for statistical purposes.

		Brood Year and Age Class				
		1998	1997	1996	1995	
		1.2	1.3	1.4	1.5	Total
Stratum 1:	6/23 - 7/6					
Sampling Dates:	7/1 - 7/4					
Male:	Number in Sample:	76	41	10	0	127
	Estimated % of Escapement:	45.8	24.7	6	0	76.5
	Estimated Escapement:	1,377	743	181	0	2,301
	Standard Error:	113.4	98.1	54.1	0	
Female:	Number in Sample:	0	13	24	2	39
	Estimated % of Escapement:	0	7.8	14.5	1.2	23.5
	Estimated Escapement:	0	235	435	36	706
	Standard Error:	0	61.1	80	24.8	
Total:	Number in Sample:	76	54	34	2	166
	Estimated % of Escapement:	45.8	32.5	20.5	1.2	100
	Estimated Escapement:	1,377	978	616	36	3,007
	Standard Error:	113	107	92	24.8	
Stratum 2:	7/7 - 7/13					
Sampling Dates:	7/8 - 7/11					
Male:	Number in Sample:	67	38	6	1	112
	Estimated % of Escapement:	49.3	27.9	4.4	0.7	82.4
	Estimated Escapement:	1,256	712	112	19	2,099
	Standard Error:	106.7	95.8	43.8	18.2	
Female:	Number in Sample:	2	8	12	2	24
	Estimated % of Escapement:	1.5	5.9	8.8	1.5	17.6
	Estimated Escapement:	37	150	225	37	450
	Standard Error:	25.7	50.2	60.5	25.7	
Total:	Number in Sample:	69	46	18	3	136
	Estimated % of Escapement:	50.7	33.8	13.2	2.2	100
	Estimated Escapement:	1,293	862	337	56	2,549
	Standard Error:	106.7	101	72.3	31.4	

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		Brood Year and Age Class				
		1998	1997	1996	1995	
		1.2	1.3	1.4	1.5	Total
Stratum 3:	7/14 - 7/20					
Sampling Dates:	7/15 - 7/17					
Male:	Number in Sample:	93	39	17	1	150
	Estimated % of Escapement:	48.7	20.4	8.9	0.5	78.5
	Estimated Escapement:	799	335	146	9	1,289
	Standard Error:	55.9	45.1	31.9	8.1	
Female:	Number in Sample:	0	13	28	0	41
	Estimated % of Escapement:	0	6.8	14.7	0	21.5
	Estimated Escapement:	0	112	241	0	352
	Standard Error:	0	28.2	39.6	0	
Total:	Number in Sample:	93	52	45	1	191
	Estimated % of Escapement:	48.7	27.2	23.6	0.5	100
	Estimated Escapement:	799	447	387	9	1,641
	Standard Error:	55.9	49.8	47.5	8.1	
Stratum 4:	7/21 - 7/27					
Sampling Dates:	7/22 - 7/24					
Male:	Number in Sample:	72	65	15	1	153
	Estimated % of Escapement:	37.9	34.2	7.9	0.5	80.5
	Estimated Escapement:	272	245	57	4	577
	Standard Error:	21.7	21.2	12.1	3.2	
Female:	Number in Sample:	0	7	25	5	37
	Estimated % of Escapement:	0	3.7	13.2	2.6	19.5
	Estimated Escapement:	0	26	94	19	140
	Standard Error:	0	8.4	15.1	7.2	
Total:	Number in Sample:	72	72	40	6	190
	Estimated % of Escapement:	37.9	37.9	21.1	3.2	100
	Estimated Escapement:	272	272	151	23	717
	Standard Error:	21.7	21.7	18.2	7.8	

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		Brood Year and Age Class				
		1998	1997	1996	1995	
		1.2	1.3	1.4	1.5	Total
Stratum 5:	7/28 - 8/3					
Sampling Dates:	7/29 - 8/1					
Male:	Number in Sample:	26	23	4	0	53
	Estimated % of Escapement:	40	35.4	6.2	0	81.5
	Estimated Escapement:	115	102	18	0	235
	Standard Error:	15.5	15.1	7.6	0	
Female:	Number in Sample:	0	1	7	4	12
	Estimated % of Escapement:	0	1.5	10.8	6.2	18.5
	Estimated Escapement:	0	4	31	18	53
	Standard Error:	0	3.9	9.8	7.6	
Total:	Number in Sample:	26	24	11	4	65
	Estimated % of Escapement:	40	36.9	16.9	6.2	100
	Estimated Escapement:	115	106	49	18	288
	Standard Error:	15.5	15.3	11.9	7.6	
Stratum 6:	8/4 - 9/19					
Sampling Dates:	8/5 - 8/7					
Male:	Number in Sample:	14	4	2	0	20
	Estimated % of Escapement:	51.9	14.8	7.4	0	74.1
	Estimated Escapement:	100	29	14	0	143
	Standard Error:	17.5	12.5	9.2	0	
Female:	Number in Sample:	0	0	7	0	7
	Estimated % of Escapement:	0	0	25.9	0	25.9
	Estimated Escapement:	0	0	50	0	50
	Standard Error:	0	0	15.4	0	
Total:	Number in Sample:	14	4	9	0	27
	Estimated % of Escapement:	51.9	14.8	33.3	0	100
	Estimated Escapement:	100	29	64	0	193
	Standard Error:	17.5	12.5	16.5	0	

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		Brood Year and Age Class				
		1998	1997	1996	1995	
		1.2	1.3	1.4	1.5	Total
Strata 1-5:	6/23 - 9/19					
Male:	Number in Sample:	348	210	54	3	615
	% Males in Age Group:	59	32.6	8	0.5	100
	Estimated % of Escapement:	46.7	25.8	6.3	0.4	79.1
	Estimated Escapement:	3,918	2,166	528	31	6,644
	Standard Error:	168.5	147.2	78.5	20.2	
	Estimated Design Effects:	1.345	1.335	1.239	1.307	1.339
Female:	Number in Sample:	2	42	103	13	160
	% Females in Age Group:	2.1	30.1	61.4	6.3	100
	Estimated % of Escapement:	0.4	6.3	12.8	1.3	20.9
	Estimated Escapement:	37	528	1,076	110	1,751
	Standard Error:	25.7	84.5	110.4	37.2	
	Estimated Design Effects:	1.723	1.423	1.291	1.266	1.339
Total:	Number in Sample:	350	252	157	16	775
	Estimated % of Escapement:	47.1	32.1	19.1	1.7	100
	Estimated Escapement:	3,956	2,694	1,604	141	8,395
	Standard Error:	168.5	157.8	129.1	42.2	
	Estimated Design Effects:	1.344	1.347	1.276	1.275	

Appendix 6. – Estimated age and sex composition of weekly sockeye salmon escapements through the Kwethluk River weir, Alaska, 2001; and estimated design effects of the stratified sampling design. Strata with small sample sizes were combined with adjacent strata for statistical purposes.

		Brood Year and Age Class				
		1998	1997	1996	1996	
		1.2	1.3	1.4	2.3	Total
Stratum 1:	6/23 - 7/6					
Sampling Dates:	7/1 - 7/3					
Male:	Number in Sample:	0	3	0	1	4
	Estimated % of Escapement:	0	23.1	0	7.7	30.8
	Estimated Escapement:	0	23	0	8	30
	Standard Error:	0	11.2	0	7.1	
Female:	Number in Sample:	3	5	1	0	9
	Estimated % of Escapement:	23.1	38.5	7.7	0	69.2
	Estimated Escapement:	23	38	8	0	69
	Standard Error:	11.2	13	7.1	0	
Total:	Number in Sample:	3	8	1	1	13
	Estimated % of Escapement:	23.1	61.5	7.7	7.7	100
	Estimated Escapement:	23	61	8	8	99
	Standard Error:	11.2	13	7.1	7.1	
Stratum 2:	7/7 - 7/13					
Sampling Dates:	7/8 - 7/11					
Male:	Number in Sample:	2	5	1	0	8
	Estimated % of Escapement:	15.4	38.5	7.7	0	61.5
	Estimated Escapement:	9	22	4	0	36
	Standard Error:	5.3	7.2	3.9	0	
Female:	Number in Sample:	1	3	0	1	5
	Estimated % of Escapement:	7.7	23.1	0	7.7	38.5
	Estimated Escapement:	4	13	0	4	22
	Standard Error:	3.9	6.2	0	3.9	
Total:	Number in Sample:	3	8	1	1	13
	Estimated % of Escapement:	23.1	61.5	7.7	7.7	100
	Estimated Escapement:	13	36	4	4	58
	Standard Error:	6.2	7.2	3.9	3.9	

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		Brood Year and Age Class				
		1998	1997	1996	1996	
		1.2	1.3	1.4	2.3	Total
Stratum 3:	7/14 - 7/20					
Sampling Dates:	7/16 - 7/17					
Male:	Number in Sample:	1	3	0	0	4
	Estimated % of Escapement:	14.3	42.9	0	0	57.1
	Estimated Escapement:	9	27	0	0	35
	Standard Error:	8.3	11.8	0	0	
Female:	Number in Sample:	0	2	1	0	3
	Estimated % of Escapement:	0	28.6	14.3	0	42.9
	Estimated Escapement:	0	18	9	0	27
	Standard Error:	0	10.8	8.3	0	
Total:	Number in Sample:	1	5	1	0	7
	Estimated % of Escapement:	14.3	71.4	14.3	0	100
	Estimated Escapement:	9	44	9	0	62
	Standard Error:	8.3	10.8	8.3	0	
Stratum 4:	7/21 - 7/27					
Sampling Dates:	7/23					
Male:	Number in Sample:	1	3	0	0	4
	Estimated % of Escapement:	14.3	42.9	0	0	57.1
	Estimated Escapement:	2	6	0	0	8
	Standard Error:	1.4	2	0	0	
Female:	Number in Sample:	0	2	1	0	3
	Estimated % of Escapement:	0	28.6	14.3	0	42.9
	Estimated Escapement:	0	4	2	0	6
	Standard Error:	0	1.8	1.4	0	
Total:	Number in Sample:	1	5	1	0	7
	Estimated % of Escapement:	14.3	71.4	14.3	0	100
	Estimated Escapement:	2	10	2	0	14
	Standard Error:	1.4	1.8	1.4	0	

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		Brood Year and Age Class				
		1998	1997	1996	1996	
		1.2	1.3	1.4	2.3	Total
Stratum 5:	7/28 - 8/24					
Sampling Dates:	7/29					
Male:	Number in Sample:	0	0	0	0	0
	Estimated % of Escapement:	0	0	0	0	0
	Estimated Escapement:	0	0	0	0	0
	Standard Error:	0	0	0	0	
Female:	Number in Sample:	0	2	0	0	2
	Estimated % of Escapement:	0	100	0	0	100
	Estimated Escapement:	0	39	0	0	39
	Standard Error:	0	0	0	0	
Total:	Number in Sample:	0	2	0	0	2
	Estimated % of Escapement:	0	100	0	0	100
	Estimated Escapement:	0	39	0	0	39
	Standard Error:	0	0	0	0	
Strata 1-5:	6/23 - 8/24					
Male:	Number in Sample:	4	14	1	1	20
	% Males in Age Group:	18.1	70.9	4.1	6.9	100
	Estimated % of Escapement:	7.3	28.6	1.6	2.8	40.3
	Estimated Escapement:	20	78	4	8	110
	Standard Error:	10	17.9	3.9	7.1	
	Estimated Design Effects:	0.977	1.022	0.684	1.181	0.933
Female:	Number in Sample:	4	14	3	1	22
	% Females in Age Group:	16.8	69.1	11.4	2.7	100
	Estimated % of Escapement:	10	41.2	6.8	1.6	59.7
	Estimated Escapement:	27	112	18	4	162
	Standard Error:	11.9	18.1	11	3.9	
	Estimated Design Effects:	1.012	0.87	1.23	0.684	0.933
Total:	Number in Sample:	8	28	4	2	42
	Estimated % of Escapement:	17.3	69.8	8.4	4.4	100
	Estimated Escapement:	47	190	23	12	272
	Standard Error:	15.4	18.4	11.7	8.1	
	Estimated Design Effects:	1.073	1.044	1.151	1.017	

Appendix 7. – Estimated age and sex composition of weekly coho salmon escapements through the Kwethluk River weir, Alaska, 2001; and estimated design effects of the stratified sampling design. Strata with small sample sizes were combined with adjacent strata for statistical purposes.

		Brood Year and Age Class			
		1999	1998	1997	
		1.1	2.1	3.1	Total
Stratum 1:	7/28 - 8/3				
Sampling Dates:	7/29 - 7/30				
Male:	Number in Sample:	1	4	3	8
	Estimated % of Escapement:	8.3	33.3	25	66.7
	Estimated Escapement:	24	96	72	191
	Standard Error:	23.4	39.9	36.7	
Female:	Number in Sample:	0	4	0	4
	Estimated % of Escapement:	0	33.3	0	33.3
	Estimated Escapement:	0	96	0	96
	Standard Error:	0	39.9	0	
Total:	Number in Sample:	1	8	3	12
	Estimated % of Escapement:	8.3	66.7	25	100
	Estimated Escapement:	24	191	72	287
	Standard Error:	23.4	39.9	36.7	
Stratum 2:	8/4 - 8/10				
Sampling Dates:	8/8 - 8/8				
Male:	Number in Sample:	2	38	5	45
	Estimated % of Escapement:	2.1	40.4	5.3	47.9
	Estimated Escapement:	12	231	30	274
	Standard Error:	7.8	26.6	12.2	
Female:	Number in Sample:	0	38	11	49
	Estimated % of Escapement:	0	40.4	11.7	52.1
	Estimated Escapement:	0	231	67	298
	Standard Error:	0	26.6	17.4	
Total:	Number in Sample:	2	76	16	94
	Estimated % of Escapement:	2.1	80.9	17	100
	Estimated Escapement:	12	462	97	572
	Standard Error:	7.8	21.3	20.4	

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		Brood Year and Age Class			
		1999	1998	1997	
		1.1	2.1	3.1	Total
Stratum 3:	8/11 - 8/24				
Sampling Dates:	8/19 - 8/20				
Male:	Number in Sample:	1	71	3	75
	Estimated % of Escapement:	0.7	47	2	49.7
	Estimated Escapement:	55	3,890	164	4,109
	Standard Error:	54.3	334.1	93.4	
Female:	Number in Sample:	0	71	5	76
	Estimated % of Escapement:	0	47	3.3	50.3
	Estimated Escapement:	0	3,890	274	4,164
	Standard Error:	0	334.1	119.8	
Total:	Number in Sample:	1	142	8	151
	Estimated % of Escapement:	0.7	94	5.3	100
	Estimated Escapement:	55	7,780	438	8,273
	Standard Error:	54.3	158.5	149.9	
Stratum 4:	8/25 - 8/31				
Sampling Dates:	8/27				
Male:	Number in Sample:	1	84	10	95
	Estimated % of Escapement:	0.6	54.5	6.5	61.7
	Estimated Escapement:	26	2,159	257	2,442
	Standard Error:	25.2	156.2	77.3	
Female:	Number in Sample:	1	53	5	59
	Estimated % of Escapement:	0.6	34.4	3.2	38.3
	Estimated Escapement:	26	1,363	129	1,517
	Standard Error:	25.2	149.1	55.6	
Total:	Number in Sample:	2	137	15	154
	Estimated % of Escapement:	1.3	89	9.7	100
	Estimated Escapement:	51	3,522	386	3,959
	Standard Error:	35.5	98.3	93	

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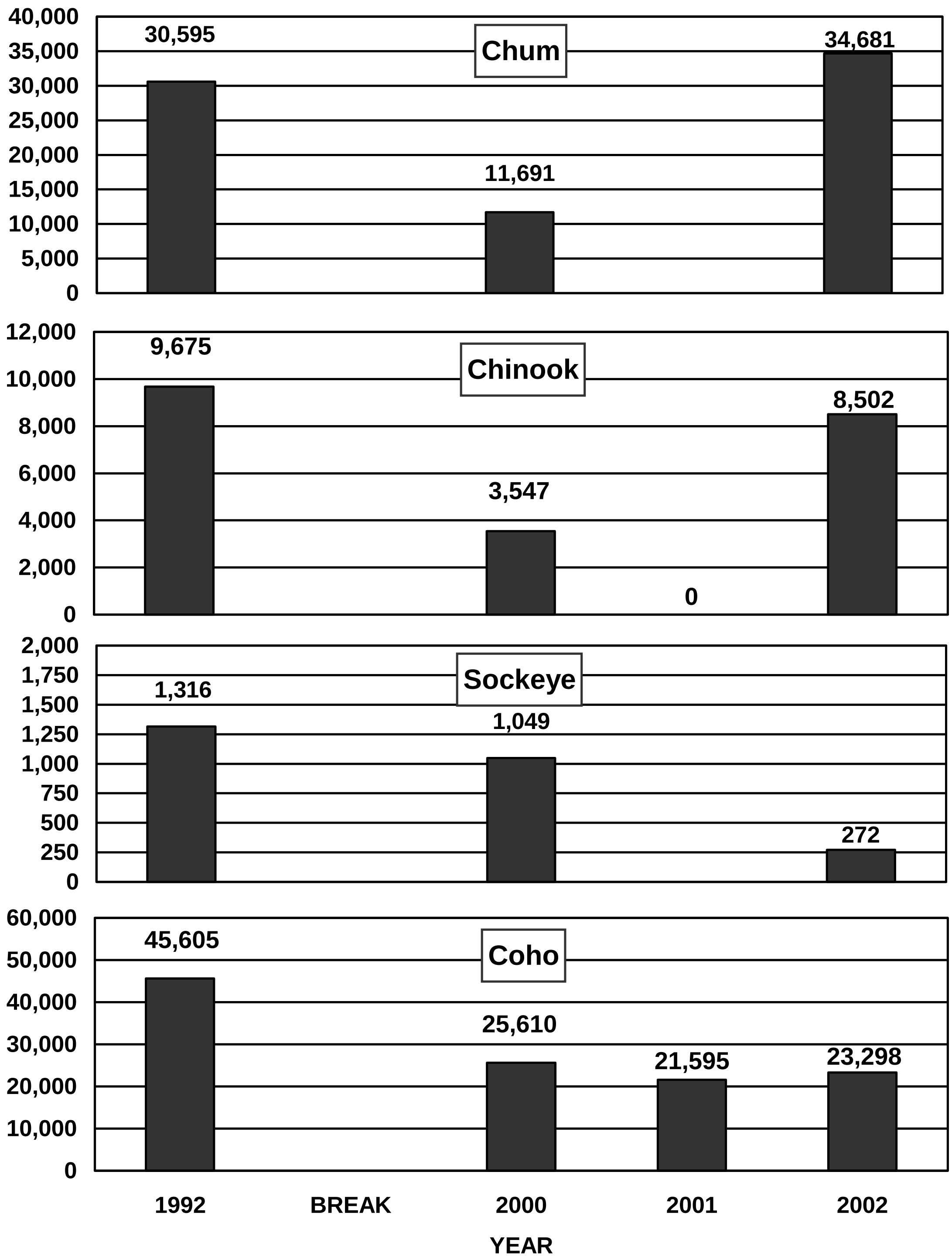
		Brood Year and Age Class			
		1999	1998	1997	
		1.1	2.1	3.1	Total
Stratum 5:	9/1 - 9/19				
Sampling Dates:	9/2 - 9/3				
Male:	Number in Sample:	2	87	2	91
	Estimated % of Escapement:	1.3	54.7	1.3	57.2
	Estimated Escapement:	128	5,585	128	5,842
	Standard Error:	89.8	401	89.8	
Female:	Number in Sample:	1	64	3	68
	Estimated % of Escapement:	0.6	40.3	1.9	42.8
	Estimated Escapement:	64	4,108	193	4,365
	Standard Error:	63.7	395.1	109.6	
Total:	Number in Sample:	3	151	5	159
	Estimated % of Escapement:	1.9	95	3.1	100
	Estimated Escapement:	193	9,693	321	10,207
	Standard Error:	109.6	176.1	140.6	
Strata 1-5:	7/28 - 9/19				
Male:	Number in Sample:	7	284	23	314
	% Males in Age Group:	1.9	93	5.1	100
	Estimated % of Escapement:	1.1	51.3	2.8	55.2
	Estimated Escapement:	245	11,961	652	12,858
	Standard Error:	110.7	546.9	155.7	
	Estimated Design Effects:	1.259	1.28	0.959	1.281
Female:	Number in Sample:	2	230	24	256
	% Females in Age Group:	0.9	92.8	6.3	100
	Estimated % of Escapement:	0.4	41.6	2.8	44.8
	Estimated Escapement:	90	9,688	662	10,440
	Standard Error:	68.5	540.6	172.5	
	Estimated Design Effects:	1.304	1.285	1.154	1.281
Total:	Number in Sample:	9	514	47	570
	Estimated % of Escapement:	1.4	92.9	5.6	100
	Estimated Escapement:	335	21,649	1,314	23,298
	Standard Error:	129.7	260.5	229.5	
	Estimated Design Effects:	1.27	1.105	1.061	



Appendix 8. – Historic escapement of salmon (except pink) at the Kwethluk River weir, Alaska. Breaks indicate periods when a weir was not operated. Years with no data indicate counts too low to allow an accurate estimate.

Appendix 9. – Length (mm) at age for chum salmon, Kwethluk River weir, Alaska 2002.

			Brood Year and Age Class			
Sampling Dates			1999	1998	1997	1996
(Stratum Dates)	Sex		0.2	0.3	0.4	0.5
7/1, 7/2, 7/3	Male	Mean Length		601	623	627
(6/23-7/6)		Std. Error		3	4	9
		Range		550 - 650	580 - 660	610 - 640
		Sample Size	0	56	38	3
	Female	Mean Length	530	583	585	610
		Std. Error		5	8	
		Range	530 - 530	515 - 625	520 - 620	610 - 610
		Sample Size	1	27	20	1
7/7, 7/8, 7/11	Male	Mean Length	578	597	617	630
(7/7 - 7/13)		Std. Error	13	3	6	
		Range	565 - 590	530 - 695	560 - 690	630 - 630
		Sample Size	2	68	28	1
	Female	Mean Length	555	572	588	
		Std. Error		3	6	
		Range	555 - 555	520 - 625	550 - 655	
		Sample Size	1	71	21	
7/15	Male	Mean Length	565	598	618	658
(7/14 - 7/20)		Std. Error		3	7	7
		Range	565 - 565	555 - 665	540 - 670	645 - 670
		Sample Size	1	57	20	3
	Female	Mean Length		569	577	575
		Std. Error		2	5	9
		Range		510 - 605	520 - 615	560 - 590
		Sample Size	0	69	20	3
7/22	Male	Mean Length	546	592	595	
(7/21 - 7/27)		Std. Error	8	3	9	
		Range	525 - 570	510 - 640	510 - 650	
		Sample Size	5	73	20	0
	Female	Mean Length	558	566	570	
		Std. Error	12	3	11	
		Range	540 - 590	510 - 605	530 - 615	
		Sample Size	4	71	8	0

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Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class 1999 0.2	1998 0.3	1997 0.4	1996 0.5
7/29 (7/28 - 8/3)	Male	Mean Length	563	592	594	620
		Std. Error	8	3	9	
		Range	505 - 615	535 - 660	540 - 690	620 - 620
		Sample Size	14	70	20	1
	Female	Mean Length	543	554	563	555
		Std. Error	11	3	5	
		Range	510 - 570	490 - 615	540 - 590	555 - 555
		Sample Size	5	60	11	1
8/5, 8/6, 8/7 (8/4 - 8/10)	Male	Mean Length	572	581	592	550
		Std. Error	8	4	20	
		Range	520 - 635	500 - 640	500 - 655	550 - 550
		Sample Size	12	50	9	1
	Female	Mean Length	528	540	549	
		Std. Error	5	4	10	
		Range	490 - 580	470 - 630	480 - 625	
		Sample Size	31	59	14	0
8/19, 8/20 (8/11 - 8/24)	Male	Mean Length	547	571		
		Std. Error	39	19		
		Range	500 - 625	530 - 610		
		Sample Size	3	4	0	0
	Female	Mean Length	495	501		
		Std. Error		26		
		Range	495 - 495	350 - 590		
		Sample Size	1	8	0	0
Seasonal	Male	Mean Length	559	595	614	640
		Std. Error	9	1	3	6
		Range	500 - 635	500 - 695	500 - 690	550 - 670
		Sample Size	37	378	135	9
	Female	Mean Length	535	565	579	579
		Std. Error	4	2	3	9
		Range	490 - 590	350 - 630	480 - 660	555 - 610
		Sample Size	43	365	94	5

Appendix 10. – Length (mm) at age for chinook salmon. Kwethluk River weir, Alaska, 2002.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class 1998 1.2	1997 1.3	1996 1.4	1995 1.5
7/1, 7/2, 7/3, 7/4	Male	Mean Length	546	688	818	
(6/23 - 7/6)		Std. Error	6	12	25	
		Range	430 - 700	505 - 870	690 - 930	
		Sample Size	76	41	10	0
	Female	Mean Length		702	842	878
		Std. Error		17	8	18
		Range		610 - 795	770 - 950	860 - 895
		Sample Size	0	13	24	2
7/8, 7/9, 7/10, 7/11	Male	Mean Length	546	657	778	980
(7/7 - 7/13)		Std. Error	7	12	61	
		Range	410 - 700	510 - 840	600 - 990	980 - 980
		Sample Size	67	38	6	1
	Female	Mean Length	603	739	855	975
		Std. Error	3	39	12	45
		Range	600 - 605	625 - 900	790 - 930	930 - 1020
		Sample Size	2	8	12	2
7/15, 7/16, 7/17	Male	Mean Length	556	653	800	970
(7/14 - 7/20)		Std. Error	5	9	28	
		Range	435 - 690	555 - 760	570 - 1010	970 - 970
		Sample Size	93	39	17	1
	Female	Mean Length		715	851	
		Std. Error		27	12	
		Range		620 - 945	705 - 940	
		Sample Size	0	13	28	0
7/22, 7/23, 7/24	Male	Mean Length	544	687	804	835
(7/21 - 7/27)		Std. Error	5	10	19	
		Range	350 - 620	550 - 850	695 - 920	835 - 835
		Sample Size	72	65	15	1
	Female	Mean Length		726	860	923
		Std. Error		30	14	28
		Range		630 - 800	725 - 1000	840 - 1010
		Sample Size	0	7	25	5

Appendix 10. – (Page 2 of 2)

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class 1998 1.2	1997 1.3	1996 1.4	1995 1.5
7/29, 7/30, 7/31, 8/1	Male	Mean Length	520	664	830	
(7/28 - 8/3)		Std. Error	10	11	26	
		Range	420 - 600	590 - 760	775 - 885	
		Sample Size	26	23	4	0
	Female	Mean Length		785	854	926
		Std. Error		20	4	
		Range		785 - 785	800 - 955	915 - 930
		Sample Size	0	1	7	4
8/5, 8/6, 8/7	Male	Mean Length	543	668	860	
(8/4 - 9/19)		Std. Error	13	9	140	
		Range	480 - 620	640 - 680	720 - 1000	
		Sample Size	14	4	2	0
	Female	Mean Length			849	
		Std. Error			14	
		Range			805 - 910	
		Sample Size	0	0	7	0
Seasonal	Male	Mean Length	547	671	804	606
		Std. Error	3	6	19	
		Range	410 - 700	505 - 870	570 - 1010	835 - 980
		Sample Size	348	210	54	3
	Female	Mean Length	603	717	849	926
		Std. Error	3	16	5	19
		Range	600 - 605	610 - 945	705 - 1000	840 - 1020
		Sample Size	2	42	103	13

Appendix 11. – Length (mm) at age for coho salmon. Kwethluk River weir, Alaska, 2002.

			Brood Year and Age Class		
Sampling Dates			1999	1997	1997
(Stratum Dates)	Sex		1.1	2.1	3.1
7/29, 7/30	Male	Mean Length	440	559	573
(6/28 - 8/3)		Std. Error		17	22
		Range	440 - 440	510 - 580	530 - 605
		Sample Size	1	4	3
	Female	Mean Length		548	
		Std. Error		6	
		Range		540 - 565	
		Sample Size	0	4	0
8/5, 8/6, 8/7, 8/8	Male	Mean Length	573	569	527
(8/4 - 8/10)		Std. Error	53	9	34
		Range	520 - 625	450 - 680	435 - 640
		Sample Size	2	38	5
	Female	Mean Length		572	540
		Std. Error		6	16
		Range		475 - 680	450 - 660
		Sample Size	0	38	11
8/19, 8/20	Male	Mean Length	565	583	597
(8/11 - 8/24)		Std. Error		5	9
		Range	565 - 565	490 - 680	585 - 615
		Sample Size	1	71	3
	Female	Mean Length		579	630
		Std. Error		4	26
		Range		465 - 660	575 - 720
		Sample Size	0	71	5
8/27	Male	Mean Length	530	603	595
(8/25 - 8/31)		Std. Error		4	19
		Range	530 - 530	490 - 675	475 - 670
		Sample Size	1	84	10
	Female	Mean Length	590	583	560
		Std. Error		6	14
		Range	590 - 590	450 - 655	530 - 610
		Sample Size	1	53	5

Appendix 11. – (Page 2 of 2)

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class 1999 1.1	1997 2.1	1997 3.1
9/2, 9/3	Male	Mean Length	535	611	595
(9/1 - 9/19)		Std. Error	40	4	90
		Range	495 - 575	505 - 675	505 - 685
		Sample Size	2	84	2
	Female	Mean Length	575	597	613
		Std. Error		3	26
		Range	575 - 575	510 - 650	565 - 655
		Sample Size	1	64	3
Seasonal	Male	Mean Length	532	598	589
		Std. Error	35	2	20
		Range	440 - 625	450 - 680	435 - 685
		Sample Size	7	284	23
	Female	Mean Length	580	586	599
		Std. Error		2	11
		Range	575 - 590	450 - 680	450 - 720
		Sample Size	2	230	24

Appendix 12. – Daily counts for all species, including effort, net marked salmon, and estimates of missed passage, Kwethluk River weir, Alaska, 2002.

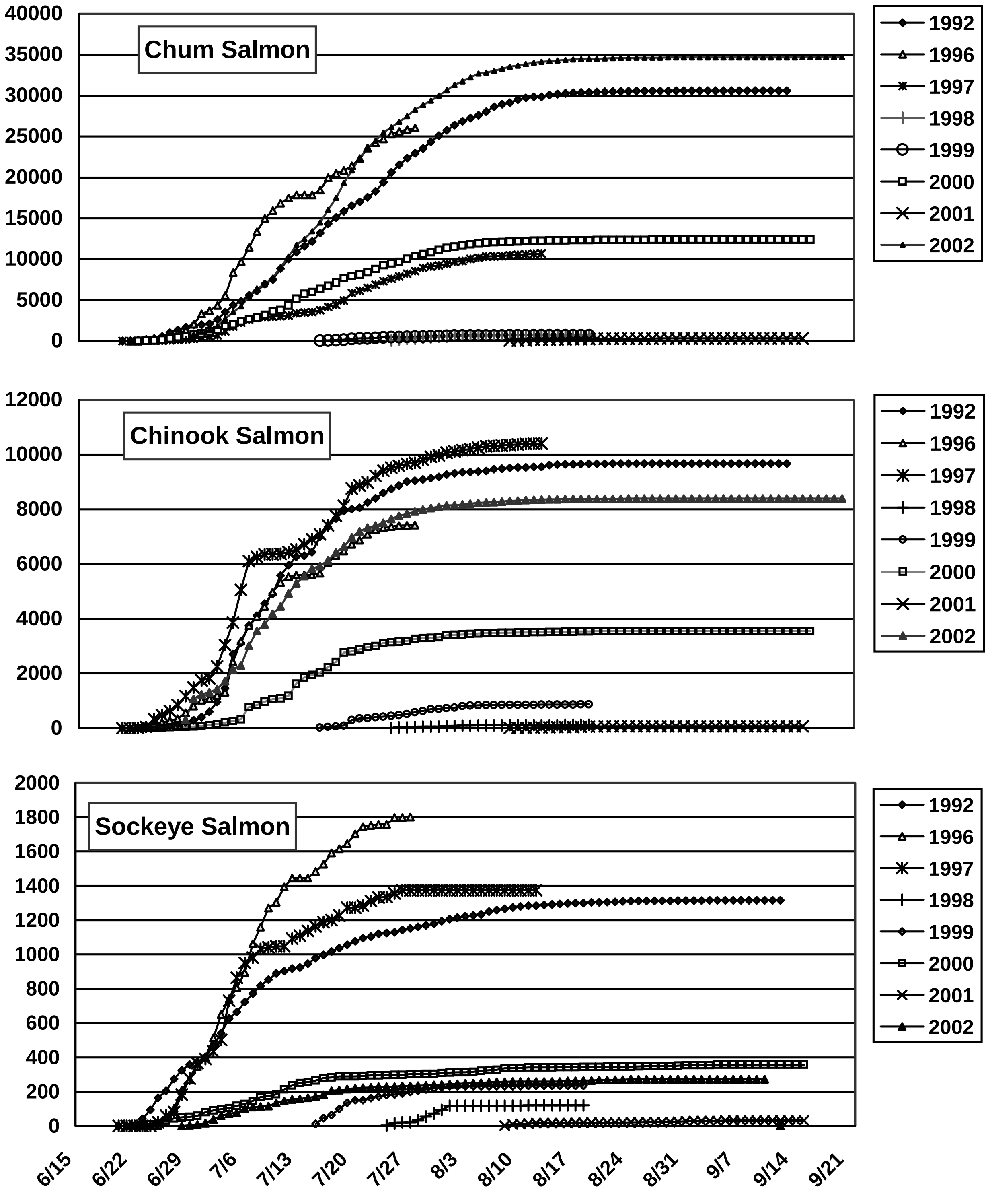
							Gillnet Marked									
Date	Counting Effort	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
6/22		48	1													
6/23		89	6													
6/24		116	9													
6/25		224	19													
6/26		384	32													
6/27		312	40													
6/28	8.00	234	307	0	0	0	10	4	0	0	0	1	0	0	0	1
6/29	18.00	581	760	4	18	0	24	40	0	0	0	2	1	0	0	0
6/30	17.00	320	168	3	3	0	23	7	0	0	0	0	0	0	0	0
7/1	14.50	214	83	9	4	0	10	2	0	0	0	0	0	0	0	0
7/2	9.50	482	111	21	9	0	25	18	0	0	0	0	0	0	0	0
7/3	14.50	882	291	22	24	0	71	19	0	0	0	1	1	0	0	0
7/4	14.50	823	426	11	24	0	61	31	0	0	0	0	5	0	0	0
7/5	20.00	708	144	7	32	0	62	8	0	0	0	1	1	0	0	1
7/6	19.75	1,283	717	22	74	0	68	33	0	0	0	5	1	0	0	1
7/7	19.75	925	540	10	69	0	85	42	0	0	0	0	2	0	0	0
7/8	14.50	448	246	4	17	0	22	3	0	0	0	0	0	0	0	0
7/9	14.00	853	388	2	36	0	78	43	0	0	0	1	0	0	0	1
7/10	14.75	1,291	266	19	42	0	38	3	0	0	0	0	0	0	0	0
7/11	16.75	1,281	486	11	40	0	47	23	0	0	0	0	0	0	0	0
7/12	17.75	1,423	360	9	55	0	27	3	0	0	0	1	3	0	0	0
7/13	18.00	722	263	3	28	0	24	14	0	0	0	2	1	0	0	0
7/14	16.00	949	275	6	25	0	17	3	0	0	0	2	1	0	0	0
7/15	8.50	1,073	92	7	6	0	31	3	0	0	0	0	0	0	0	0
7/16	11.50	1,538	209	12	18	0	27	4	0	0	0	0	0	0	0	0
7/17	15.00	1,496	288	22	25	0	55	17	0	0	0	5	0	0	0	1
7/18	18.00	1,792	211	4	38	0	23	14	0	0	0	0	4	0	0	0
7/19	18.00	1,530	334	6	33	0	16	4	0	0	0	0	2	0	0	0
7/20	18.00	1,545	232	5	34	0	13	3	0	0	0	0	0	0	0	0

Appendix 12. – (Page 2 of 3)

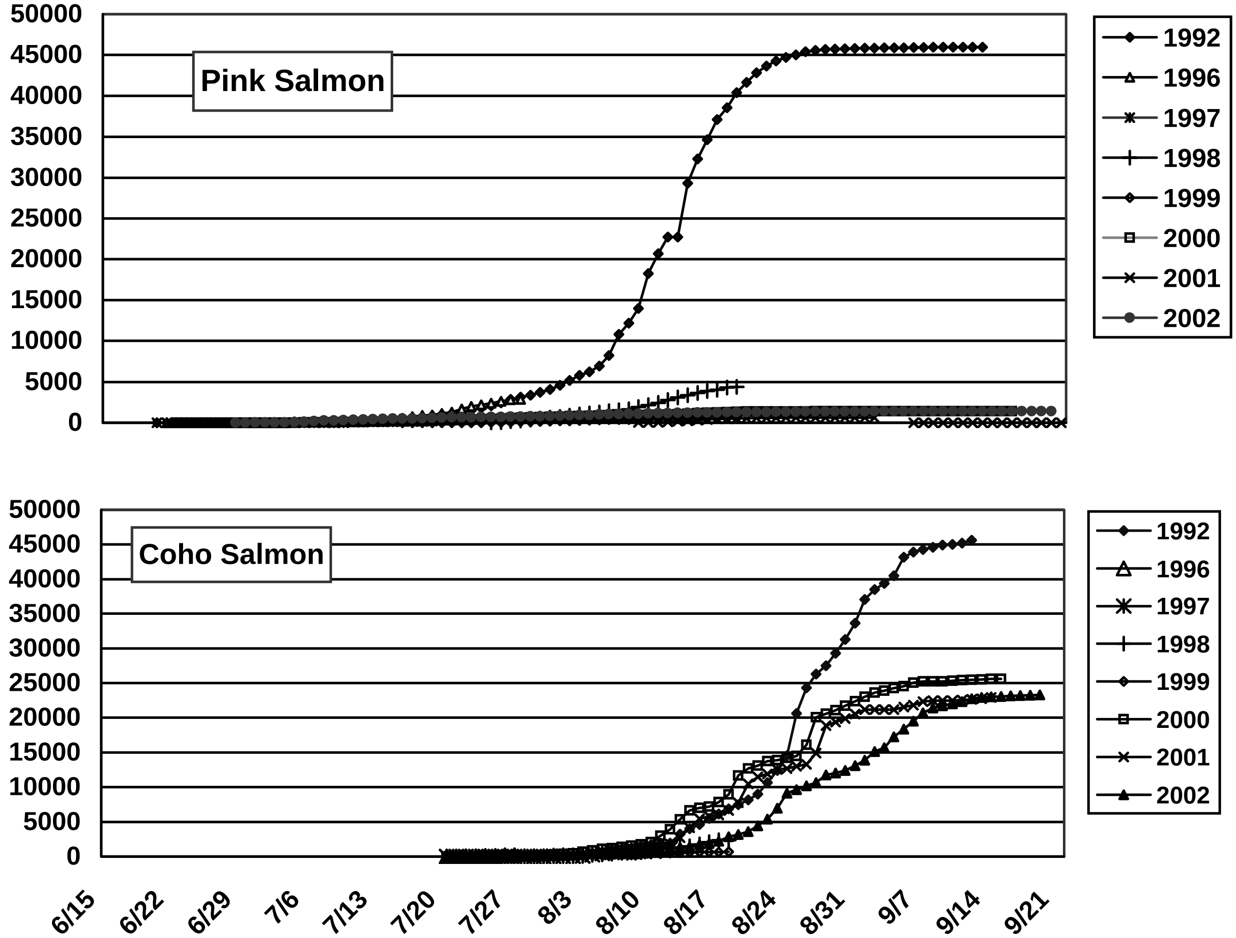
							Gillnet Marked									
Date	Counting Effort	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
7/21	18.00	1,231	124	3	18	0	15	4	0	0	0	3	0	0	0	0
7/22	13.00	841	81	2	10	0	12	2	0	0	0	0	0	0	0	0
7/23	11.75	1,002	103	4	9	0	5	2	0	0	0	0	0	0	0	0
7/24	12.25	675	137	0	8	0	10	1	0	0	0	2	0	0	0	0
7/25	18.00	672	114	0	19	0	5	0	0	0	0	1	0	0	0	0
7/26	18.00	698	71	5	22	0	3	0	0	0	0	2	2	0	0	0
7/27	18.00	786	87	0	24	0	7	0	0	0	0	1	0	0	0	0
7/28	16.00	557	73	1	24	0	5	1	0	0	0	1	1	0	0	0
7/29	10.75	540	57	2	15	15	7	0	0	0	0	0	0	0	0	0
7/30	13.25	631	51	2	25	17	2	0	0	0	0	1	0	0	0	0
7/31	11.50	627	42	2	29	52	14	2	0	0	0	1	10	0	0	0
8/1	15.75	633	17	3	38	58	9	0	0	0	0	1	1	0	0	0
8/2	17.00	441	26	1	32	60	7	0	0	0	0	4	1	0	0	0
8/3	17.00	489	22	3	31	85	10	0	0	0	0	0	1	0	0	0
8/4	17.00	463	30	2	67	114	4	0	0	0	0	4	1	0	0	0
8/5	12.00	117	20	2	16	22	1	0	0	0	0	0	2	0	0	1
8/6	13.00	240	13	3	32	51	2	0	0	0	3	0	0	0	0	0
8/7	10.50	235	16	3	20	51	1	0	0	0	1	0	3	0	0	0
8/8	14.25	264	27	0	23	47	1	0	0	0	2	0	1	0	0	0
8/9	16.00	126	13	1	18	45	0	0	0	0	0	0	1	0	0	0
8/10	15.50	187	14	0	39	242	0	0	0	0	0	0	0	0	0	0
8/11	16.00	163	16	1	18	112	0	0	0	0	0	0	0	0	0	0
8/12	16.00	113	6	0	26	300	1	0	0	0	0	0	3	0	0	1
8/13	16.00	72	10	0	16	80	0	0	0	0	0	1	1	0	0	0
8/14	15.75	74	3	0	16	101	0	0	0	0	0	1	0	0	0	0
8/15	15.50	80	7	0	14	282	0	0	0	0	2	0	0	0	0	0
8/16	15.50	52	6	4	7	164	0	0	0	0	0	0	1	0	0	0
8/17	15.00	41	2	0	7	332	0	0	0	0	0	0	0	0	0	0
8/18	16.00	35	0	1	16	651	0	0	0	0	1	0	0	0	0	0

Appendix 12. – (Page 3 of 3)

							Gillnet Marked									
Date	Counting Effort	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
8/19	11.00	31	2	0	3	309	0	0	0	0	1	1	0	0	0	0
8/20	12.25	36	1	4	9	390	0	0	0	0	3	0	1	0	0	0
8/21	14.75	26	1	0	2	845	0	0	0	0	1	0	8	0	0	0
8/22	15.50	21	0	1	8	986	0	0	0	0	1	1	6	0	0	0
8/23	15.00	18	1	0	9	1,573	0	0	0	0	15	2	20	0	0	0
8/24	14.50	10	0	3	21	2,148	0	0	0	0	8	0	22	0	0	0
8/25	15.50	8	2	0	16	500	0	0	0	0	1	0	108	0	0	0
8/26	15.50	7	0	0	1	560	0	0	0	0	0	0	44	0	0	1
8/27	8.75	11	0	0	0	478	0	0	0	0	4	0	6	0	0	0
8/28	15.00	5	1	0	7	1,110	0	0	0	0	22	0	50	0	0	0
8/29	15.00	5	0	0	3	255	0	0	0	0	1	0	29	0	0	0
8/30	15.00	4	0	0	2	364	0	0	0	0	0	0	19	0	0	0
8/31	14.00	3	0	0	16	692	0	0	0	0	15	0	17	0	0	0
9/1	14.50	4	0	0	6	778	0	0	0	0	15	0	7	0	0	0
9/2	11.75	3	0	0	10	1,255	0	0	0	1	10	0	15	0	0	0
9/3	13.25	1	0	0	0	544	0	0	0	0	7	0	4	0	0	0
9/4	14.50	2	1	0	2	1,598	0	0	0	1	29	0	9	0	0	0
9/5	14.00	2	0	0	3	1,090	1	0	0	0	21	0	6	0	0	0
9/6	14.00	2	0	0	2	1,140	0	0	0	0	30	0	9	0	0	0
9/7	13.00	0	0	0	0	1,203	0	0	0	0	29	0	19	0	0	0
9/8	14.00	0	1	0	0	707	0	0	0	0	8	0	8	0	0	0
9/9	15.00	1	0	0	0	303	0	0	0	0	2	0	8	0	0	0
9/10	14.00	1	0	0	0	308	0	0	0	0	8	0	11	0	0	0
9/11	14.00	0	0	0	0	290	0	0	0	0	3	0	10	0	0	0
9/12	13.25	1	0	0	1	448	0	0	0	0	2	0	21	0	0	0
9/13	13.75	1	0	0	0	178	0	0	0	0	9	0	5	0	0	0
9/14	13.75	0	0	0	0	68	0	0	0	0	0	0	1	0	0	0
9/15	13.50	0	0	0	0	68	0	0	0	0	0	0	2	0	0	0
9/16	13.50	0	0	0	0	81	0	0	0	0	0	0	5	0	0	0
9/17	10.00	0	0	0	0	47	0	0	0	0	0	0	2	0	0	0
9/18	13.00	0	0	0	0	47	0	0	0	0	0	0	1	0	0	0
9/19	13.00	0	0	0	1	54	0	0	0	0	0	1	0	0	0	0
Totals	1228.00	35,854	8,502	272	1,415	23,298	979	353	0	2	254	49	524	0	0	8



Appendix 13. – Cumulative escapement for chum, chinook and sockeye salmon from the Kwethluk River weir (1992, 2000-2002) and counting tower (1996-1998).



Appendix 14. – Cumulative escapement for pink and coho salmon from the Kwethluk River weir (1992, 2000-2002) and counting tower (1996-1998).